

Remarks

In view of the above amendments and the following remarks, reconsideration and further examination are requested.

Claims 12, 25 and 30 have been rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. Claims 12, 25 and 30 have been amended so as to recite that the wire material portion does not directly contact the IC electrode or the circuit forming surface. This limitation is clearly supported by the specification, for example, by at least Figure 4, element 43. As a result, withdrawal of the rejection under 35 U.S.C. §112, first paragraph, is respectfully requested.

Claims 12, 13 and 21-35 have been rejected under 35 U.S.C. §103(a) as being unpatentable over DiStefano (US 5,518,964) in view of Khandros (US 5,917,707). Claims 12, 25 and 40 have been amended so as to further distinguish the present invention from the references relied upon in the rejections. As a result, the rejections are submitted to no longer be applicable for the following reasons.

Claim 12 is patentable over the combination of DiStefano and Khandros, since claim 12 recites a semiconductor arrangement comprising, in part, a bump electrode having a first protrusion and a second protrusion bonded to an IC electrode on a circuit forming surface of a semiconductor element, the first protrusion having a formed portion formed by a melted portion and a wire material portion comprising a portion of a wire in a vicinity of the melted portion, the wire material portion extending from a vertex portion of the formed portion toward the semiconductor element and being bonded to the formed portion, wherein the bump electrode is approximately V-shaped, and a bottom portion of the 'V' faces towards the semiconductor element in a direction approximately perpendicular to the circuit forming surface. The combination of DiStefano and Khandros fails to disclose or suggest a bump electrode having a first protrusion and a second protrusion as recited in claim 12.

DiStefano discloses a component 84 connected to a semiconductor wafer 86 via a lead 60. The wafer 86 has a contact 90 on a top surface 92 thereof to which a tip end 68 of the lead 60 is attached with a button 80. The component 84 is connected to a terminal end 66 of the lead 60 to thereby be connected to the wafer 86. The lead 60 is formed such that it has a first bight (bend) 111

and a second bight (bend) 113 therein. (See column 11, line 12 - column 13, line 4 and Figures 14-17).

In the rejection of claim 12, the button 80 is indicated as corresponding to the first protrusion and the first bight 111 is indicated as corresponding to the second protrusion. However, it is clear from Figures 14-17 that the tip end 68 of the lead 60 does not extend from the vertex of the button 80 toward the wafer 86. Instead, the lead 60 extends from a middle portion of the button 80 in a direction that is parallel to the wafer 86. As a result, DiStefano fails to disclose or suggest the wire material portion as recited in claim 12.

Further in the rejection of claim 12, it appears that the second bight 113 is indicated as forming the claimed V-shape. However, it is again clear from Figures 14-17 that the second bight 113 does not extend in a direction approximately perpendicular to the top surface 92 of the wafer 86. Instead, the second bight 113 extends in an angular direction towards the wafer 86. As a result, DiStefano fails to disclose or suggest the V-shaped bump electrode as recited in claim 12. Therefore, in order for the combination of DiStefano and Khandros to render claim 12 obvious, Khandros must disclose or suggest these features.

Khandros discloses a flexible contact structure that can be used to connect electric components. In one embodiment, a flexible contact structure 136 is made up of a flexible elongated conductive element 137 having two bends 137a and 137b formed therein and a ball bond 138 at a first end and a ball bond 139 at a second end. In another embodiment, a semiconductor package assembly 401 is a printed circuit board 411 which carries circuitry including contact pads 412 on a first side and contact pads 413 on a second side. Semiconductor devices 416 and 417 are provided on opposite sides of the printed circuit board 411 and carry resilient structures 418. The resilient structures 418 are bonded to the contact pads 412 and 413 and an encapsulant 419 is formed around the resilient structures 418. (See column 7, lines 17-44 and Figure 3 and column 16, line 60 - column 17, line 14 and Figure 25).

Based on the above description and the illustrations of Figures 3 and 25, it is apparent that while the elongated conductive element 137 and the resilient structures 418 have a number of bends therein. However, the elongated conductive element 137 does not extend from a vertex of either of the ball bonds 138 and 139 towards the surfaces to which the ball bonds 138 and 139 attach. Further,

the resilient structures 418 do not extend from a vertex of a portion by which they are attached to a surface towards the respective surfaces to which they are attached. As a result, Khandros fails to disclose or suggest the wire material portion as recited in claim 12.

In addition, it is apparent that while the elongated conductive element 137 and the resilient structures 418 have a number of bends therein, neither the elongated conductive element 137 or the resilient structures 418 are approximately V-shaped with a bottom portion of the 'V' facing towards an electric component 102 and the printed circuit board 411 in a direction approximately perpendicular to the electric component 102 and the printed circuit board 411, respectively. Instead, the bends in the elongated conductive element 137 and the resilient structures 418 face substantially along a plane parallel to surfaces to which they are mounted. As a result, Khandros fails to disclose or suggest the V-shaped bump electrode as recited in claim 12.

Since Khandros fails to address the deficiencies of DiStefano, it is apparent that the combination of DiStefano and Khandros fails to disclose or suggest the present invention as recited in claim 12.

Claim 25 is patentable over the combination of DiStefano and Khandros, since claim 25 recites a semiconductor arrangement comprising, in part, a bump electrode having a first protrusion and a second protrusion bonded to an IC electrode on a circuit forming surface of a semiconductor element, wherein the first and second protrusions have substantially a same height and are either both in contact with or substantially equally close to an electrode on a circuit board when the semiconductor element is mounted on the circuit board, and the first protrusion has a formed portion formed by a melted portion and a wire material portion comprising a portion of a wire in a vicinity of the melted portion, the wire material portion extending from a vertex portion of the formed portion toward the semiconductor element and being bonded to the formed portion. The combination of DiStefano and Khandros fails to disclose or suggest a bump electrode having a first protrusion and a second protrusion as recited in claim 25.

As discussed above, DiStefano discloses a component 84 connected to a semiconductor wafer 86 via a lead 60. The wafer 86 has a contact 90 on a top surface 92 thereof to which a tip end 68 of the lead 60 is attached with a button 80. The component 84 is connected to a terminal end 66 of the lead 60 to thereby be connected to the wafer 86. The lead 60 is formed such that it has a first bight

(bend) 111 and a second bight (bend) 113 therein. (See column 11, line 12 - column 13, line 4 and Figures 14-17).

The rejection indicates that the button 80 of DiStefano corresponds to the first protrusion and the first bight 111 corresponds to the second protrusion. However, it is clear from Figures 14-17 that the button 80 and the first bight 111 do not have substantially a same height. Further, the rejection appears to also indicate that the button 80 corresponds to both the first protrusion and the second protrusion. However, it is not clear how the button 80 could correspond to both of these elements at the same time. As a result, DiStefano fails to disclose or suggest the first and second protrusions as recited in claim 25. Therefore, in order for the combination of DiStefano and Khandros to render the present invention as recited in claim 25 obvious, Khandros must disclose or suggest this feature.

As discussed above, Khandros discloses the elongated conductive element 137 and the resilient structures 418 having a number of bends therein. The rejection indicates that the free ends and the bends of the elongated conductive element 137 and the resilient structures 418 correspond to the protrusions as recited in claim 25. (See column 7, lines 17-44 and Figure 3 and column 16, line 60 - column 17, line 14 and Figure 25). However, it is apparent from Figures 3 and 25 that no pair of a free end and a bend or pair of bends in the elongated conductive element 137 or the resilient structures 418 are both of a same height. Instead, the ends and bends are all at different levels along the lengths of the elongated conductive element 137 and the resilient structures 418.

Further, in another embodiment of Khandros, a semiconductor package 461 has a printed circuit board 462 having vertical via conductors or plated through-holes 463 extending therethrough. A semiconductor device 466 is provided with resilient contact structures 467 that have a plurality of bends 467a and 467b. The semiconductor device 466 can be mounted to the printed circuit board 462 by placing the resilient contact structures 467 into the through-holes 463 such that the resilient contact structures 467 contact the surface of each of the through-holes 463 twice to hold the semiconductor device 466 in place. (See column 18, lines 21-41 and Figure 28). However, while Khandros discloses that each of the resilient contact structures 467 contact the surface of the through-holes 463 twice, it is apparent that the portions of the resilient contact structures 467 do not have substantially a same height, since the through-holes 463 are contacted at two different levels. As a result, Khandros fails to disclose or suggest the present invention as recited in claim 25.

Since Khandros fails to address the deficiency of DiStefano, it is apparent that the combination of DiStefano and Khandros fails to disclose or suggest this feature of claim 25.

Further, it is noted that claim 25 is also patentable over the combination of DiStefano and Khandros for one of the reasons set forth above in support of claim 12. That is, claim 25 also recites a wire material portion which is not disclosed or suggested by the combination of DiStefano and Khandros

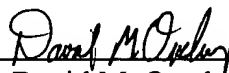
As for claim 30, it is also patentable over the combination of DiStefano and Khandros for one of the reasons set forth above in support of claim 12. That is, claim 30, like above claim 12, recites, in part, a wire material portion extending from a vertex portion of a formed portion toward a semiconductor element, which feature is not disclosed or suggest by the combination of DiStefano and Khandros.

Because of the above mentioned distinctions, it is believed clear that claims 12, 13 and 21-35 are patentable over the combination of DiStefano and Khandros. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention would not have been motivated to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 12, 13 and 21-35. Therefore, it is submitted that claims 12, 13 and 21-35 are clearly allowable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

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